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Journal:	*Regional Studies*
Manuscript ID:	CRES-2005-0239.R1
Manuscript Type:	Main Section
JEL codes:	F23 - Multinational Firms|International Business < F2 - International Factor Movements and International Business < F - International Economics, O21 - Planning Models|Planning Policy < O2 - Development Planning and Policy < O - Economic Development, Technological Change, and Growth, R58 - Regional Development Policy < R5 - Regional Government Analysis < R - Urban, Rural, and Regional Economics
Keywords:	Buyer-supplier Linkages, China, Electronic industry, Foreign Direct Investment, Industrial Cluster

Formation of FDI Clustering - A New Path to Local Economic Development?

The Case of Qingdao

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Abstract. – This paper investigates the clustering of Chinese electronics manufacturers, large and small, alongside established foreign producers in Qingdao, North China. It examines how the supplier-buyer linkages between foreign invested enterprises (FIEs) and local firms has driven the development of a successful electronic industry cluster around development zones established by the local authority, underpinning the success of the large domestic firms both at home and abroad. We also analyze how FIE's collaboration with local firms foster local economic development in Qingdao. By integrating the theoretical perspectives of hub-and-spoke model from economic geography and flagship-and-five partner's model in the science of strategic management, we develop our own theoretical lens to investigate the inter-firm network between the FIEs and local firms. The secret of the success of the Chinese electronic producers lies in their ability to drive, rather than being subordinate to, this network.

Key words – foreign direct investment, industrial cluster, buyer-supplier linkages, China,

electronics industry

JEL classification: F23, O21, R58

INTRODUCTION

The fact that inflows of foreign direct investment (FDI) into less developed countries (LDCs) are unevenly distributed, often concentrated in urban centres and more developed areas, has been a matter of considerable concern to the scholarly world. However, such a pattern may have perfectly logical explanations, not only by the reason that host governments often set up specially designated zones to attract FDI, but also that necessary conditions, such as infrastructure, required by FDI is confined to urban areas in the host countries. Moreover, there are some evidences that geographical concentration of FDI may represent a more powerful development catalyst than dispersed one (Fromhold-Eisebith, 2002; Thompson 2002; Zhou and Tong, 2003; Zhou, 2005). The purpose of this paper is to further explore the relationship between FDI, industrial clusters and local economic development by seeking to cross-link the FDI and clusters literature. It draws insights from a case study of China's most successful electronics cluster in Qingdao.

China's FDI inflows surpassed those of the United States in 2002 for the first time, making China the world's largest recipient of FDI, with manufacturing sectors receiving a lion's share (69.4%) (China Statistical Yearbook, 2003). Meanwhile, in 2003, China manufactured more than 30% of the world's household electronics goods. In 2004, China produced electronics goods valued at 296 billion USD, making it the second largest electronic producer in the world (Lee, 2005). Interestingly, however, the relationship

between FDI inflows and China's success in the international electronics market is not a simple one. While foreign-invested enterprises (FIEs) account for almost 70% of the China's electronic exports, they are not among the largest and most successful household appliance producers and exporters from China. Indeed, that dominant position is occupied by several large Chinese firms, notably Haier from Qingdao and TCL from Guangdong. Qingdao, the home city of Haier, has become a magnet for other important indigenous local electronic producers, such as Hisense and Aucma, as well as a large collection of specialised FIE. In 2001, with a world market share of 5.3%, Haier has ranked second in the global refrigerator production industry (People's Daily, 13th Jan. 2002).

These features immediately raise several interesting questions: How does FDI affect the success of Chinese electronic enterprises? Why is Qingdao a magnet for electronic producers? What effect does this have on the overseas competitiveness of the Chinese producers? And what is in turn the impact of the latter on the local economy? These are obviously significant questions in their own right, especially because China's phenomenal economic growth in the past quarter of a century is to a large extent propelled by exports growth. However, in this paper, we are principally interested in exploring the underlying theoretical issues and empirical evidence at the clustering of FDI.

In theoretical terms, the existing literature on FDI, while recognising the potential benefits in terms of the inflow of capital and managerial know-how, transfer of technology, marketing expertise and market links, places considerable emphasis on FDI's potentially adverse effect on the domestic market structure, primarily because it is thought that, given their ownership-specific advantages and their sizes, transnational corporations (TNCs) are

likely to dominate the market and hinder competition by exercising their market power although initially they may enhance competition (UNCTAD 1995, 1997). The question as to whether FIEs are capable of playing a dynamic role in developing the local industry is rarely addressed. In the meantime, in development practice, attracting inward FDI constitutes one of the most important development strategies at the local level (Friedmann, 2002).

Existing studies have established that most of the positive effects of inward FDI are transmitted through inter-firm linkages, especially through supplier-buyer relationship between local firms and FIEs (Lall 1980; PACEC 1995; Yeung and Li, 2000; Tong and Wang, 2000; Wang and Tong 2002; Crone and Roper 2001; Dicken, 2003). Moreover, the quality and the dynamic nature of the linkages is the key to the extent of the impact. Turok (1993) identifies two different types of linkage structure: development structure and dependency structure. In the former, FIEs share information and technology with local firms, strengthening a sustainable partnership. In the later, by contrast, the main purpose of FDI is to minimise the production costs by exploiting local resources, most notably labour, and therefore information and technology sharing is limited. Apparently then, the crucial question is under what conditions the more desired structure would develop. The case of Qingdao that we examine below may shed useful light on this. It is further noted that inter-firm relationship is also addressed in the literature from the different perspectives of industrial clusters (Best, 1990; Markusen, 1996), flagship and five partners model (Rugman and D'Cruz, 2000) and global value chains (Bair and Gereffi, 2001; Humphrey and Schmitz, 2000; Humphrey and Schmitz, 2002; Schmitz, 2004).

Thompson (2002) argued that the intra – and inter-industry spill-over from FIEs into local economies are similar to mechanisms of knowledge and technology transfer identified in the literatures of industrial cluster and development studies. Hence, FIEs' engagement in the local economy can be conceptualised as contributing to industrial clustering, especially through the transfer of knowledge.

However, the literature on clusters generally focuses on the local sources of competitiveness coming from intra-cluster vertical and horizontal relationships, neglecting the potentials of firms' network from outside (Schmitz, 1995; 2004). In other words, while existing studies on cluster do acknowledge the significance of external linkages, it has been weakly theorized (Humphrey and Schmitz, 2002). Nevertheless, recent literature examines in much depth clusters' global linkages and how they affect local relationship (Schmitz, 2004). More specifically, Humphrey and Schmitz (2004a) have explained how and why global value chains are governed. They recognise that lead firms, notably global buyers, play an important role in setting and coordinating the parameters under which other firms in the chain operate. Schmitz (2004, pp. 3) presents that 'developing country clusters tend to work to specifications that come from outside.' Schmitz (2004) hypothesises that the upgrading opportunities of local producers vary with the type of value chain governance. Humphrey and Schmitz (2004b) also emphasize that effective local upgrading strategies build on strong local and global linkages. The *network-based chains* can help local enterprises to reposition themselves in the global economy.

However, local producers in developing countries rarely find themselves in such chain. Moreover, much of this new literature on clusters focuses on ties with foreign buyers,

rather than the interaction between FIEs and local firms. This is evident in both the conceptual works and empirical studies (Bair and Gereffi, 2001; Schmitz, 2004). There are however partial exceptions. For instance, Altenburg and Meyer-Stamer (1999) identifies a Weberian ideal type of cluster composed mainly of TNCs subsidiaries in Latin American, but finds that local firms, as suppliers, were weakly integrated into such clusters because of their lack of technological capacity. Similarly, Lowe and Kenney (1999) confirmed the importance of external linkages between foreign and local firms by investigating why inflows of FDI in the Mexican consumer electronics industry led to the decline of the industry. They argued that weak local and foreign ties were the main reason. Nevertheless, the above examples also point to another weakness of the existing works, namely that local firms are invariably placed in a subordinate and dependent position.

In this paper, with a case study of electronic industry in Qingdao, China, we identify a hither-unexplored scenario in which FIEs' collaboration with local firms, both large and small, actively fosters the development of the local industrial cluster. The essence of the case is that foreign firms do not constitute the core of the cluster, but have made critical contribution to the development of the cluster by introducing new and more open forms of industrial organization and technological development. More specifically, FIEs act as suppliers to large local firms and buyers for local small firms, thus playing a bridging role in the otherwise fragmented local market precisely because of their firm-specific advantages and their sizes. Moreover, this linkage directly strengthened the competitiveness of large domestic firms both at home and abroad. This paper is structured as follows. In section 2, in order to facilitate our investigation as described above, we first conceptualize clusters and global linkages. We also attempt to re-examine the scope for

infusion between the clusters and FDI literatures. We then develop an analytical framework below by combining the 'hub-and-spoke' model in the perspective of economic geography literatures and the 'flagship and five partners' model in the international strategic management. This enables us to test the hypothesis that, in the context of a large domestic market and extant industrial and organizational capacity, local firms in developing countries can turn FIEs into suppliers and develop independent strength on that basis. Section 3 briefly describes the electronic industry in Qingdao. Section 4 presents the main research findings. Section 5 concludes.

LITERATURE REVIEW AND CONCEPTUAL DEVELOPMENT

The key research question for this study is how the geographical concentration of FIEs could contribute to local industry clusters, and, as a result, to local economic development. Two bodies of literature are relevant. The first is the literature on industry clusters and factors that affect their performance and upgrading. The second is the literature on FDI and its impact on the host economy. These are reviewed below in turn.

Extending the perspective of clusters and global value chains

As stated earlier, the inter-firm relationship between local and foreign firms, which defines the nature of FDI's impact on the local industry, has not been adequately addressed in the extant works. It is therefore necessary to develop our own analytical framework that places this relationship at the centre. In doing so, we have integrated relevant concepts from mainstream literature on economic geography, international business and development

economics. This conceptual framework is able to account for two key dimensions: the geographical concentration of specialized firms; the direction of the relationship between foreign firms and local firms.

Conceptualising cluster and global linkages

The conceptual background of cluster can be traced back to Alfred Marshall's observation of industrial districts in the UK. According to Marshall (1920), the advantage of agglomeration are rooted in the reduced costs that arise from the operation of three sets of 'localization economies': first, the growth of various intermediate and subsidiary industries which provide specialized local input; second, the development of a pool of skilled labour; and third, the establishment of dedicated infrastructure and resource (Cumber and Mackinnon, 2004). A cluster is defined as 'a group of geographically concentrated firms specialising along the lines between similar and complementary activities and developing grater skills and productive knowledge' (Best, 1990, p. 233). More specifically, there are three types of clusters, namely horizontal clusters, vertical clusters and emerging clusters, have been distinguished. While horizontal clusters are characterised by a common resource base (e.g. skilled labour or infrastructure), the classic, vertical clusters displays considerable evidence of supplier-buyer linkages. So-called emerging clusters may demonstrate wide scope for vertical and horizontal linkages, but not currently well established (Held, 1996).

According to Schmitz (1995), the concept of industrial district gained new analytical life when Becattini (1990) used it to make sense of the successful performance of local firms in

Tuscany, Emilia Romagna and nearby regions in what has come to be called the 'Third Italy'. Becattini went beyond Marshall's economic analysis, however, and stressed the need for an interdisciplinary approach. He defined the industrial district as a 'socio territorial entity which is characterized by the presence of both a community of people and a population of firms' and he adds that 'in the district, unlike in other environments ... community and firms tend to merge' (1990, p. 38). In the ensuing international debate, the stylized model of the Third Italy has become the main reference point. The main components of this model are: geographical and sectoral concentration of predominantly small- and medium-sized enterprises; vertical disintegration at the firm level; cooperative competition; a socio-cultural identity which facilitates trust; active self-help organizations (Schmitz 1995, p. 10).

A special issue of World Development (Schmitz and Nadvi, 1999) was devoted to the topic of industrial clusters in developing countries. One of the most crucial findings is the need to explore linkages external to the cluster. Subsequent work on clusters, particularly in developing countries, has concentrated on exploring the way in which firms in clusters are linked to external actors and its impact on the cluster's performance and local development. This endeavour has ushered in the perspective of the global value chain (Schmitz, 2004, p. 6).

'Central to value chain analysis is the observation that there are lead firms, notably global buyers, which set and enforce the parameters under which other firms in the chain operate.'

In this respect, global value chain analysis emphasizes that local producers learn a great

deal from global buyers about how to improve their production processes, attain consistent and high quality and increase the speed of response. In other words, global lead firms play an important role in determining the upgrading opportunities of local producers (Humphrey and Schmitz, 2002). However, it is evident from the discussion that the global value chain approach has focused on foreign buyers, rather than foreign producers in the locality. The problem with this omission is that it has seriously hampered our understanding of how foreign subsidiaries may affect the dynamics of a cluster.

Role of FDI and FIEs in industry clusters

The literature on FDI provides important insights into how FIEs may be incorporated into the studies of clusters. According to Dunning (1993), FDI is characterised by firm-specific advantage in knowledge and technical know-how. This underpins a consensus that FDI brings in not only financial resource, but more importantly knowledge of various kinds. Therefore their presence can have a wider impact on the local knowledge base either through their own R&D activities, or engaging in supplier development activities or simply having a demonstrative effect on local firms (Young *et al*, 1988). However, the use of FDI as a means to technology and knowledge is efficient only as long as sufficient absorptive capacity of the technologies exists locally (Borensztein *et al*, 1998). In addition, though, the right 'market' conditions should exist for domestic firms to learn (Dunning and Narula, 2004).

Birkinshaw (2000) examines the impact of FDI on the evolution of industrial clusters. He found that the outcome depends on the dynamism of the cluster and the maturity of the

industry concerned. While FDI has more limited, though positive impact on well established clusters in a mature industry, the impact on emerging clusters in a high-growth industry may well be significant.

However, Birkinshaw was clearly more concerned with the financial flows that FDI would bring, although he pays heed to potential technology transfer. On the other hand, he has not really look into the nature of inter-firm linkages. He has not touched upon the positive externality that FDI may have for the rest of the economy. In this regard, one of the most interesting points from the literature is that normal trading relationships between firms is a network form of organisation, and that, in the absence of a highly developed institutional and producer service infrastructure, such collaboration may prove the most important means of technology transfer (Phelps, 1996). It has been established that the key linkages which affect the extent and nature of clustering and FIEs include local inputs, notably labour, market linkages with suppliers and sources of other intermediate inputs; interaction with customers; networking, collaboration and competition with firms and organizations other than customers and suppliers; collective learning and creativity (Nachum and Keeble, 2001). There is now considerable evidence that the clustering of FDI could amplify the positive effects. Fromhold-Eisebith (2002) shows that clustering of TNCs' branches facilitated upgrading of the local IT industry in Bangalore, India, through the labour market and generated positive spill-over effects by promoting the development of infrastructure, education and local governance.

In the same line of argument, Zhou and Tong (2003) demonstrates that by merely acting as the application agent for MNCs to start with, local IT firms in Zhongguancun, Beijing –

the most important IT cluster in China – have achieved considerable technological learning, which has directly contributed to the success of the cluster in the home market. Moreover, they find that 'as the relationship between MNCs and local firms are not only hierarchical, but also interdependent and *evolutionary* the learning capacity of local firms can be significantly improved by the presence of other related companies and R&D facilities, and by a developmental state in a market-oriented spatial cluster' (Zhou, 2005, p. 1116).

Theoretically, this effect could be amplified further in manufacturing, where forward and backward linkages are significant. This is because manufacturing plants purchase a variety of different inputs including raw materials and components, services, machinery and equipment, utilities, and labour. If these inputs are purchased from within the host region, this will provide a boost to the regional and urban economy by stimulating increases in output and employment among the local supply industries (Hirschman, 1958). Such suppliers may then start to export to the sister affiliates as well as to other independent external purchase.

From the literature review, there is a lack of direct evidence in the potential of clustering FDI to facilitate local economic development through supporting the development of local clusters. For instance, Altenburg and Meyer-Stamer (1999) show that clusters of TNCs subsidiaries in Latin America induced further inflow of FDI, when suppliers followed the demand for parts and semi-components, and gave rise to positive externalities such as the formation of a local pool of trained workers and the accumulated experience of local authorities and trade associations in dealing with foreign investors. However, local firms were weakly integrated into such clusters as suppliers due to poor technological capacity.

On the other hand, Thompson (2002) studied FIEs' technology transfer to local firms by investigating Hong Kong garment firms in China. In his research, technology transfer to local firms by geographically concentrated FIEs was compared with that of geographically dispersed FIEs. He concluded that FIEs enhance technological development of local firms; more specifically, geographically concentrated FIEs were better than dispersed FIEs in transferring technology and managerial skills via training and spill-over to Chinese firms. In another instance, Tong and Wang (2000) documented the case of Dongguan city in South China, where the formation of a local PC manufacturing cluster, involving both local and foreign firms, fuelled sustained economic development in the city. However, in all these cases, local firms have not escaped from their subordinate position.

Moreover, extant studies of the effects of FDI on local clusters have so far confined their attention to transfer of knowledge on one-to-one basis. There is so far no study that explicitly deals with the possibility that FIEs may benefit local firms and industry clusters by reducing fragmentation of the local industry as well as raising level of technology. This is despite of two interesting facts: first, industry clusters in LDCs tend to suffer from fragmentation; second FIEs often show greater willingness to share knowledge. For instance, Zhou (2005) highlights the lack of inter-firm collaboration, and consequently a high degree of fragmentation in the IT cluster in Zhongguancun, Beijing. The author's survey finds that firms with foreign background tend to take a positive view towards collaborative arrangements such as subcontracting, strategic alliances, partnerships , and information sharing, while indigenous Chinese firms tend to be indifferent to or sceptical of collaboration. (p. 1127). Similar observations are noted by Althenburg and Stamer (1999)'s study of industry clusters in Latin American. They raise the prospect that FIEs

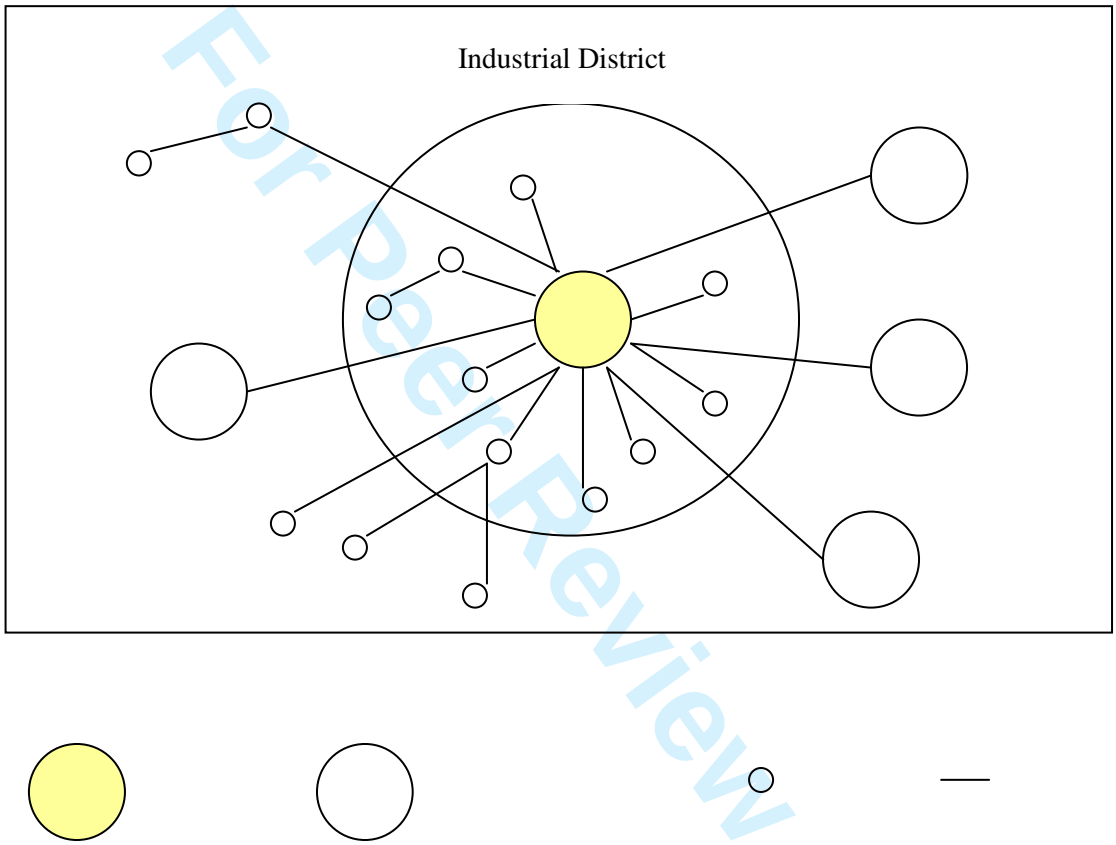
may be able to act as strong transmitters of knowledge other than those associated with the manufacturing process. They have the potential to become a promoter of more open forms of knowledge exchange and integrator of the local industry.

Developing a new analytical framework

We believe that the need to account for the direction of the inter-firm linkages between the local and foreign firms can be better addressed by combining the hub-and-spoke model from the perspective of industrial district and insights from the research on the network economy. The hub-and-spoke model from industrial district provides a useful starting point for building the analytical framework that we need. This model (Markusen, 1996) attempts to represent a regional industry by identifying a number of key firms acting as anchors or hubs to the city or regional economy, with suppliers and related activities spread out around them like spokes of a wheel. Examples are Seattle, USA and Toyota City, Japan. As shown in figure 1, a single large firm (e.g. Boeing in Seattle or Toyota in Toyota City) buys from both local and external suppliers and sells chiefly to external customers, who may be large, and masses of individual customers. Thus, the industrial districts of the hub-and-spoke construct are dominated by one or several large, vertically integrated firms, in one or more sectors, surrounded by smaller and less powerful suppliers (Markusen, 1996). The 'hub' and 'spoke' configuration highlights the dominant role played by large producers within a region in managing their needs for production capacity. The dynamism of the hub-and-spoke model is associated with the position of these hubs' organization and their national and international markets. Other local SMEs tend to have a subordinate relationship to them. Thus, the largest returns for local trade tend to be tied up as retaining

earnings in the major hub firms who are efficiently utilizing their global strategic linkages. The Hub-and-spoke model is depicted in Figure 1.

Figure 1 Hub-and-spoke model



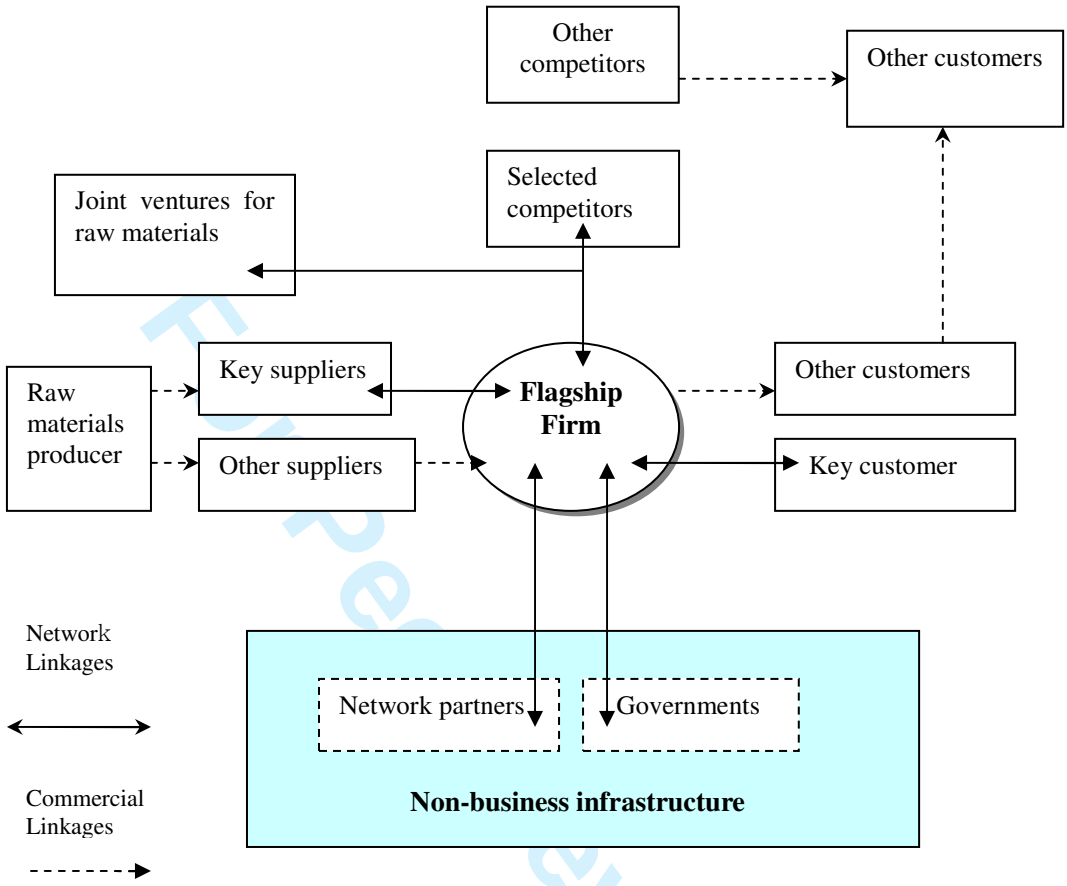
Source: Markusen (1996, p. 297)

A similar model, with emphasis on the role of a key firm, is found in strategic management literature. It is Rugman and D'Cruz's (2000) 'Flagship and five partners' model, in which the flagship firm, equipped with both the resources and a longer-term perspective, provides leadership to a vertically integrated chain of business with which it has established key relationships. The five partners consist of a flagship firm, key suppliers, key customers,

competitors, and non-business infrastructure (NBI). The last partner (NBI) refers to the non-traded service sectors, the government, social service and educational institutions. The most important role in NBI is to provide a forum or conference for co-operative exchange (Rugman and D'Cruz, 2000).

In such a model, the flagship firm makes 'the network competitive by bench-marking network activities and processes to global standards, restructuring the production and service operations to different network partners, and adopting a paradigm or relationship-based co-operation. The partners yield the strategic leadership role to the flagship firm often because it is the network's global strategic purpose that prompted the partners to join.' (p. 2). The authors further recognise that key suppliers are often expected to give near or total exclusivity to the flagship firm. In return, they benefit from increased volume and a greater portion of the value added to the product. Crucially, though, Rugman and D'Cruz (2000) confine the definition 'flagship firms' to multinational enterprises (MNEs) or transnational corporations (TNCs).

Figure 2 The flagship firm and the five partners business system



Source: Rugman and D'Cruz (2000), p. 31

As shown in Figure 2, the flagship firm lies at the hub of the business network. The relationships are shown by arrows that demonstrate the inter-firm collaboration. Double-headed arrows which cross organisational boundaries show the key partners in the business system. Conventional arm's-length relationships are shown as dotted arrows that stop at organisational boundaries (Rugman and D'Cruz, 2000). Key suppliers differ from other suppliers in that they enter into a close network relationship with the flagship firm, sharing strategies, information, resources and responsibility for the success of the network. They can expect to experience increased volumes through the flagship firm's outsourcing for activities. Key customers also develop network relationships with the flagship firm that

entails close co-operation and sharing of resources and information (Rugman and D'Cruz, 2000). A set of vendors is nestled around a large core firm, either providing inputs to the firm or distributing its inputs. The 'dynamic network' is a network in which a 'lead firm' identifies and assembles assets owned largely by other firms (Ritter and Gemunden, 2003). It is the flagship firm that provides strategic direction and purpose to the network by orchestrating the relationship among the partners. In this perspective, the 'flagship network strategy' based on long-term collaboration and learning with network partners is the organisational mechanisms for overcoming internal resources and capability transfer limits to cross-border resources transfers which are barriers to FDI (Girod and Rugman, 2005).

The discussion highlights the crucial (and potentially lucrative) role of the hub or leading firms, which is underpinned by their possession of core skills ranging from manufacturing, R&D, to design and assembly, or even pure brokering (Giroud, 2003). According to Jarillo, the TNC has a bundle of competitive advantages that are often unavailable to local indigenous firms. In this sense, this dynamic network is also 'strategic', since the 'hub firm' sets up network, and takes a proactive attitude in the care of it (Jarillo, 1995).

Therefore, the important question for us to explore is whether it is possible for local firms to play this core role, and more importantly under what conditions this may be possible. The case of Qingdao, to which we now turn our attention, provides some answers to this question.

CASE STUDY: ELECTRONIC INDUSTRY AND CLUSTER IN QINGDAO

Method and Data Collections

The primary data were collected during two phases of field work: preliminary field work between November 2001 and January 2002 and the final field work during December 2003 and April 2004. In addition, secondary data were collected from local government files, documents, and government officials and confidential statistical yearbooks. Preliminary field work involved 33 firm interviews covering various industrial sectors while the final field work investigated 34 firms only from the electric machinery, electronics and telecommunication sector. Data acquired from the preliminary field work helped to establish whether clustering activities existed and which industry is dominant[1] in Qingdao development zones. Given the information from preliminary field work, the final field work could be more sophisticatedly designed. The main source of the primary data from two field works is 83 face-to-face interviews with company managers, local and central government officials, researchers from universities and public research institutes.

The size of firms covered by the interview is varied, ranging from the largest Chinese firms and foreign invested electronic firms to those with approximately 30 employees. Hence, the sample of firms was covered whole different sized of firms. The sampled firms were chosen in various sources such as ETDZ Statistical Yearbook (2003), Qingdao Statistical Yearbook (2003, 2004) and ETDZ's Foreign Invested Enterprise Lists. Most of the company managers interviewed were managers in the supply procurement departments. With some of the companies, multiple interviews were conducted. The interviews were

[1] These two sectors accounted for more than 60% of the total gross industrial output value in Qingdao.

used to collect information on the company's buyer-supplier linkages with other local firms and FIEs and to understand the detailed procures of local and global procurement of raw materials and components in Qingdao. Because of the sensitivity nature of the matter for the company involved, all the interviews were not tape-recorded, although extensive notes were taken at the time of the interviews. The authors promised all interviewees that the information they provided will be used only for academic purposes. A list of the sampled firms in the final field work is provided in the Appendix.

Qingdao city is located in the southwest of the Shandong province on the Yellow Sea coast. Historically, being one of the open coastal cities in China under the Opium Treaty, Qingdao has been industrialized relatively early, and Qingdao port is one of China's five most important ports. More recently, Qingdao has been one of the China's fastest growing cities, more than doubling its GDP from 64.2 billion RMB in 1995 to 151.8 billion in 2002 at constant prices (1990).

Table 1 Distribution of gross industrial output value (GIOV), value added (VA) and employment in Qingdao, 2002

	GIOV Share of City total	VA Share of City total	Employment Share
Food and beverage product	5.5%	13.4%	12.0%
Tobacco products	1.9%	4.0%	0.5%
Textiles	3.7%	6.6%	10.2%
Apparel; dressing and dying of fur	1.7%	2.9%	8.3%
Tanning and dressing of leather	1.2%	4.8%	11.7%
Wood product	0.1%	0.3%	0.6%

Paper and Allied product	0.9%	1.9%	2.2%
Printing and publishing	0.6%	0.7%	1.0%
Coke and refined petroleum	1.4%	3.5%	0.8%
Chemicals	2.4%	4.3%	6.2%
Rubber and Plastics	4.7%	8.2%	11.2%
Other non-metallic products	0.9%	2.6%	3.5%
Primary metal industry	2.1%	2.4%	2.4%
Fabricated metal product	1.6%	3.9%	4.6%
Machinery and equipment	2.6%	4.9%	5.8%
Medical products	0.5%	1.0%	0.9%
Electric equipment & machinery	**36.7%**	**19.2%**	**7.1%**
Electronics and Telecommunication equipment	**24.8%**	**8.1%**	**5.6%**
Motor vehicles	6.6%	7.2%	5.7%
Total	100.0%	100.0%	100.0%

Source: Qingdao Statistical Yearbook 2003.

Furthermore, as shown in Table 1, the local industry is dominated by two sectors, namely electric equipment and machinery and electronics (including electronics and telecommunication equipment) sectors. In 2002, the two sectors accounted for more than 60% of the city's gross industrial output value and some 27% of the value added. They also provided approximately 12 percent of the city's total employment.

History plays a hand in the two sectors' pre-eminence in the local economy. Documents[2] provided from Qingdao local authority show that the electronic components industry in

[2] This document is provided by Qingdao Bureau of History and Geography (Qingdao City Electrical and electronics industry).

Qingdao was born in 1939, under the Japanese occupation, with products of recorder, electric indicator, and voltmeter. At that time, most of electronic firms were Japanese-owned. There were only ten Chinese firms in 1941. After the end of the Japanese occupation in 1945, electrical and electronic component industry flourished. Following the establishment of Qingdao Electrical and Electronic Company (Qingdao Micro Electronic Plant) in 1953, more than 110 electronic components plants were built. China's first 'silicon instrument' was developed in Qingdao city, which led to the establishment of the biggest silicon plant in China. With this success in silicon development, electronic components industry grew rapidly in Qingdao. For example, Qingdao Nanhua Components Plant, No.1 Electronic Component Plant, No. 4 Component Plant started to produce the cordless diversion equipment and micro connector in early 1960s. During 1966 to 1969, an industrial agglomeration of electronic component plants took place in the city. These included No. 2 Component Plant, Semiconductor Component Plant, Silicon Lab, Optics Measurement Institute, Qingdao Magnetic Iron Ore Plant, Electronic Counter Plant and Brown-tube Plant. These developments laid a foundation for the tremendous development of electrical and electronic industry later in the city.

From 1980 to 1985, 101 new products for electronic component were invented in Qingdao, whose sales value accounted for 16 percent of total industrial output in the city (Qingdao Electronic Association, 2004). The city also imported and utilised a total of 28 technology items from abroad. During this period, the main products were colour TV, tape recorder components, radars, cameras, air conditioners, TV tubes, integrated circuits and turners. In January 1985, deputy mayor of Qingdao made a historic contract with Sanyo Company regarding air conditioner technology, marking the beginning for Qingdao to receive core

technology and equipment in a turn-key base project. It was followed by the establishment of a comprehensive air conditioner assembly line. Afterwards, the technological skills progressed, which resulted in the localisation of major electronic components for final goods: in the case of colour TV, 80 percent of components became produced by local technology; 91.6 percent of components were localised in camera in early 1990s. Through the absorption of foreign technology, electronic industry in Qingdao city expanded rapidly.

FORMATION OF ELECTRONIC INDUSTRY CLUSTERS IN QINGDAO

Today, Qingdao is home for a number of leading electronic producers in China. As of 2003, Haier leads the Chinese electronic market with market share in refrigerator (23%), washing machine (24%), vacuum cleaner (18%), air conditioner (21%), while Hisense occupies the third place in TV market share and Aucma first in special refrigerator in China (China Electronic Industry Yearbook, 2004).

Qingdao's success is underpinned by the expansion and successful upgrading of its electronic industry cluster. A turning point in the process is the establishment of two development zones, namely Economic and Technological Development Zone and High-tech Industrial Park, respectively in 1984 and 1992. The two zones are sponsored by the local authorities and encouraged by the central government legislations.

Since its establishment, ETDZ has attracted a large amount of foreign investment and projects. During the year of 2002 alone, the value of actually utilised FDI in ETDZ was USD 473 million. In HTIP, the actually utilised value of FDI was USD 305 million (See

Table 2). Indeed, as of 2002, total amounts of FDI inflow in both zones accounted for more than 40 percent of total FDI values in Qingdao city (Huangdao ETDZ Statistical Yearbook, 2003). This fact, therefore, suggests that ETDZ and HTIP are important strategic geographical locations to attract FDI into Qingdao city.

Table 2 Ratio of FDI in GDP in ETDZ and HTIP in Qingdao

Year	Amount of FDI in ETDZ Unit: 100 million UDS	Share of FDI in GDP (%) FDI/GDP in ETDZ	Amount of FDI in HTIP Unit: 100 million USD	Share of FDI in GDP (%) FDI/GDP in HTIP
1994	1.0	54.2%	0.97	41.1%
1995	1.5	54.9%	1.14	33.2%
1996	1.7	46.6%	0.91	20.0%
1997	2.0	41.2%	1.4	23.6%
1998	2.10	34.7%	1.45	20.3%
1999	2.20	28.0%	1.7	20.4%
2000	2.89	27.9%	2.5	24.9%
2001	4.64	29.6%	2.61	20.9%
2002	4.73	23.1%	3.05	20.0%

Source: Huangdao ETDZ Statistical Yearbook (2003); Qingdao Laoshanqu Commerce Investment Guidebook by HTIP Officials (2001, 2003)

Table 2 also provides the information on percentage share of FDI in GDP in HTIP and ETDZ, respectively. From the last column of the Tables, it is clearly shown that the FDI has played a crucial role in financing the two development zones. In ETDZ, during the observed period, the share of FDI in GDP is about 38 percent, on average, with a peak of 54.9 percent in 1994. Similarly, the ratio of FDI has been around 25 percent in Qingdao

HTIP.

However, industrial development leadership has remained in the hands of locally-owned producers. In the process, suppliers have co-located around Hisense IT industrial Park and Haier Industrial Park as a part of ETDZ. Since the refrigerator plant of Haier has moved to the outskirt of Qingdao city, its component suppliers also gathered around the refrigerator plant.

This cluster is organised around three large local companies (Haier, Hisense and Aucma), and several large FIEs, including Panasonic electronic components, Mitumi Electronic, Nanya Electronic. The collaboration between the local firms and FIEs provides the vital ingredient for forming the clustering of electrical and electronic industry in Qingdao. Among the local firms, Haier plays the predominant role, acting as a hub firm of electronic industry with its major suppliers and related firms. During the period between 2001 and 2003, Haier transformed the supply network of strategic alliances by selecting and merging 2200 second and third tier suppliers into 721 key suppliers for whole range of products. This transformation is partly influenced by changing the corporate governance of Haier group. .Haier's key businesses including washing machines (Haier-Melloni), refrigerators (Haier-Carrier special refrigerator), and commercial air conditioners (Mitsubishi Heavy industry Haier) are produced by ownership of joint ventures. In case of air conditioning, Haier has benefited from Mitsubishi's global supply network. Table 3 represents more than 20 foreign invested enterprises in Haier Hi-tech Industrial Park (HTIP) and Haier Industrial Park (located in ETDZ).

Table 3 Foreign invested enterprises in Haier Group's Industrial Park (ETDZ, HTIP)

Haier Melloni Washing machine	Haier-Baihui Plastics
Mitsubishi Heavy Industry Haier (Commercial Air-conditioner	Haishimao Electronic Plastics
Haier-Happyline Kimchi Refrigerator	Haier-Weicheng Electronic Plastics
Haier-Carrier Commercial Refrigerator	Qingdao Meier Plastic
Haire CCT (Telecommunicatuin)	Haier Special Steel (Posco)
Sanyo Electronic Components (Compressor)	Haier-Haiyongli Digital Net
Sanyo Electronic Machinery (household electronic)	Haier special refrigerator
Haier Hong-ji Electrical Appliance	TDK
Haier-SKD Electronic components	Haier-Ericsson
Haier Dish washer	Haier home electronic appliance
	Haier commercial air conditioner
	Haier C-MRV

Source: Final field work (2004)

Invensys, the global leading firm in the automation and control components for household electronic goods, established local operation in 1997 is takeover of an existing firm (Qingdao electronics factory-USA Ciba Joint Venture) which previously manufactured similar types of products. The firm is located proximity[3] to the Haier's hi-tech industrial park. Invensys provides Haier with the core components (control parts) for refrigerator, washing machine, and air conditioner. In 2003, sales value was 0.2 billion RMB. The proportion of product sales is 60-70% in Qingdao development zones (HTIP and ETDZ),

[3] This company is located in HTIP but not within Haier Hi-tech Industrial Park (*Haier gao ke-ji-gong-yie-yuan).*

and other domestic market shares the 30-40% of total sales value. Hence, purpose of investment in Qingdao is to meet local demand, being a strategic location. According to interview with purchasing manager, the firm makes an effort to collaborate with Haier and other local suppliers. These efforts enable to build solid business and technological partnership among suppliers (Field work, 2004).

In this respect, Haier groups' JIT (just in time) zero distance policy plays a role in encouraging the clustering, as the main suppliers were encouraged not only to deliver the components timely, but also collaborate with Haier regarding new technology and business administration, which is assisted by E-commerce as well as face to face meeting. All these activities are coordinated by Haier Logistics Ltd, thus accelerating the formation of a household electronic cluster. Haier Logistics has attracted 36 global suppliers including Invensys and Sanyo Electronic Machinery (Compressor) to Qingdao for investment in setting factories and forming all-round supply networks that meet the requirements for quality, cost and delivery period.

As FIE has played an important part in facilitating supply networks in Qingdao, Large local firms have aggressively developed their R&D capacity. For example, Haier's central research centre in Qingdao has built a network with 60 global, regional, and local research institutes around the world. Hisense's R&D centre plays a leading role in Chinese electronic industrial development. The company has 11 research institutes for household appliance, mobile phone, information network technology, intelligent control and optical communication, employing more than 1,500 professionals and experts nationwide. By cooperating with Qingdao Semiconductor Research institutes and other Chinese research

centres and universities such as Qinghua University and Harbin University, Hisense has developed advanced technologies under the auspices of the State 863 Plan (a nationwide state-sponsored hi-tech research programme) which include the optical communication and PDP module for digital TV. Qingdao Semiconductor Research Institute was established in 1965, initially named Qingdao Semiconductor Experimental Lab. In the early days, the Institute started with 125 researchers including 20 technicians. Now the human resources are more than quadrupled and they often collaborate with the R&D centre of Hisense group for the development of high value added product such as HDTV, PDP TV. By means of several electronic training colleges established in 1990s, the city also tries to rear talented individuals from these colleges and institutions.

THE UNDERLYING DYNAMICS AND THE ROLE OF FOREIGN INVESTORS

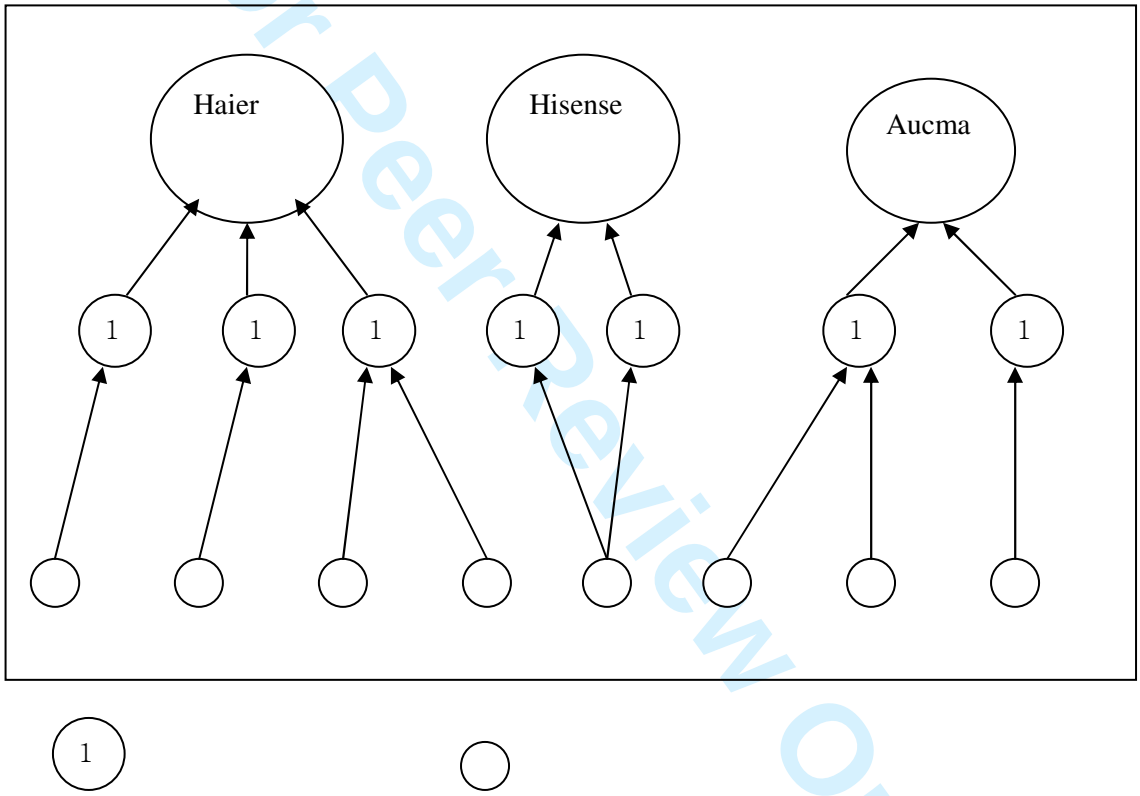
Identifying the Dynamic Change of Electronics Cluster in Qingdao

The dynamics of the local clustering is found in the specific nature of the supplier-buyer networks in Qingdao. This section presents in-depth information about such networks, on the basis of the field research.. The results provide a comprehensive picture of what happens in inter-firm networks between local firms and FIEs, looking at particular types of firms with their strategy and linkages. It also explores how the linkages between foreign and local firms have acted as a catalyst for the development and continuing expansion of the cluster.

Consistent with the conventional view of hub-and-spoke model, we found that supply networks existed around all major firms. There are however two unexpected features. First,

the hub firms are local large firms in Qingdao, while FIEs act as spoke firms. Second, FIEs nevertheless play an important role. Indeed, FIEs play a bridging role between local SMEs and large domestic firms in the buyer-supplier network. The detailed explanations are illustrated in Figure 3 and 4.

Figure 3 The structure of supply network in Qingdao during 1990s



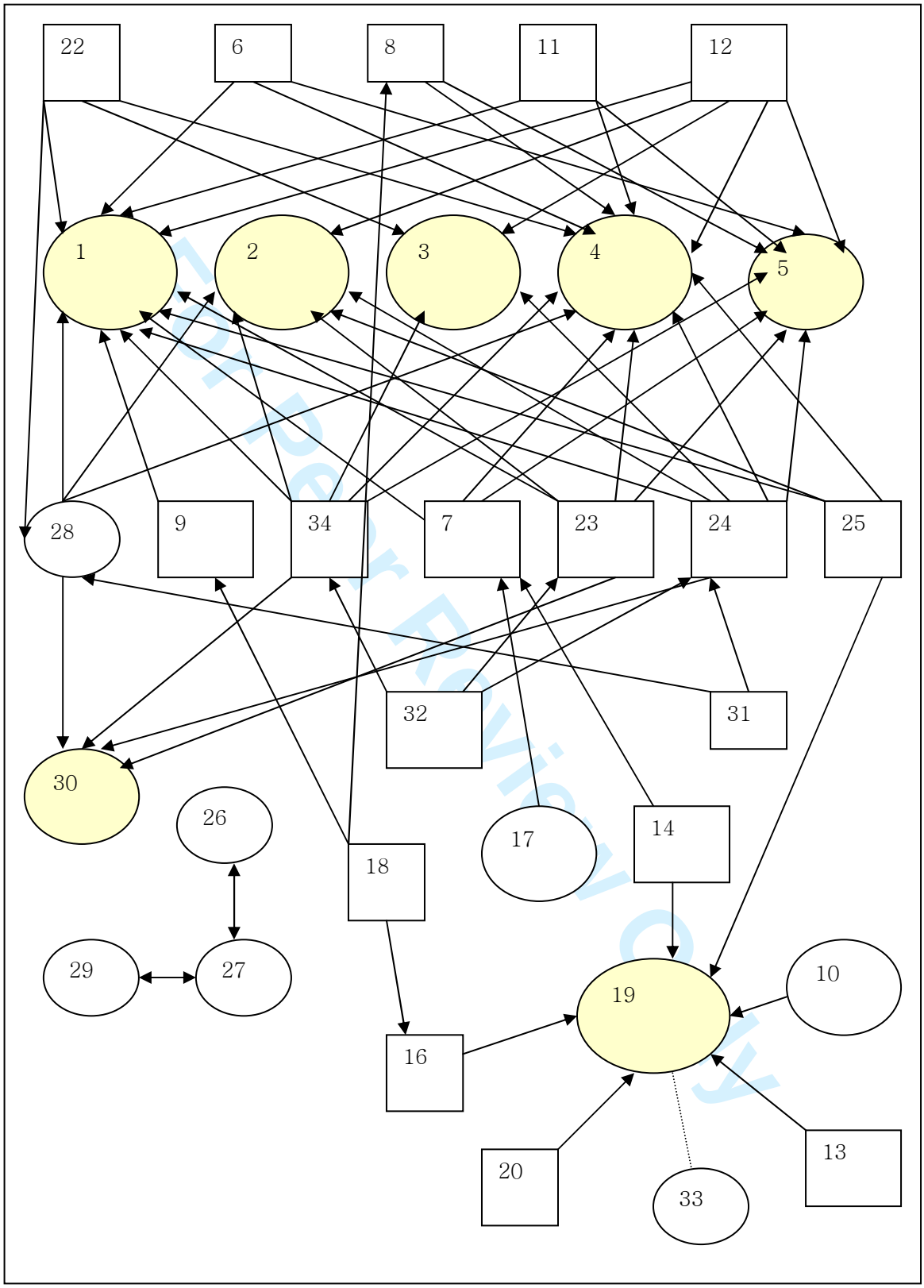
First-tier Supplier Second-tier and third-tier suppliers

Source: Interview results from final field work (2004)

Figure 3 represents the structure of the supply networks in Qingdao city during 1990s when the supply networks were incompletely constructed. At that time, the inter-firm networks were built among local firms; their structure was similar to the conventional hub-

and-spoke model where local large firms are hub and local SMEs are spokes. As illustrated in Figure 3, around the large firms, the first, second and third tier suppliers built the network as a buyer and supplier relationship. During this period, however, firms were not actively interlinked. Though vertical collaboration existed between each hub-and-spoke firms, horizontal interaction between hub firms was non-existent. So the three leading local firms competed with each other for customers, but did not share the suppliers. Indeed, Haier explicitly prohibited its suppliers to have another contract with Hisense and Aucma (Field work, 2004). However, as shown in Figure 4, inflows of FDI have transformed the structure of inter-firm linkage, giving rise to sophisticated supply networks.

Figure 4 Inter-firm linkages in Qingdao HTIP and Huangdao ETDZ (Interview results)



Source: Final field work (2004)

Firm number 1-21 (located in ETDZ) 22-34 (located in HTIP)

Figure 4 represents the network between the firms that we investigated in the development zones. It shows that the networks between the surveyed firms have become much thicker and sophisticated with inflows of FDI. Most FDI came to Qingdao in the form of wholly foreign owned company or joint ventures. Unlike practices elsewhere, however, their main purpose of investment was to provide key components and parts to local large firms, which were already major players in the domestic market. Crucially to the development of the cluster, however, when supplying the parts and components, FIEs were able to make contracts with multiple big firms because of their strength. For example, No. 34 firm in Figure 4 supplies goods to six different large firms which are numbered as 1, 2, 3, 4, 5, 30; and No. 25 firm is a supplier for four large firms numbered as 1, 2, 4, 19. Hence, the large firms numbered as 1, 2, 4 now share a foreign subcontractor for their final products. Significantly, in this kind of networks, it is the local large firms that initiate the contracts.

Moreover, foreign suppliers shared second and third tier suppliers. During the transaction between local large firms and FIEs, numerous second and third-tier suppliers are engaged as well, forming further intricate networks among suppliers. When local second or third tier suppliers receive the purchasing order from FIEs, they are also provided with detailed component specification. Manufacturing the component allows second and third tier suppliers to achieve the technology which is finally utilised for final product by local large

firms. Such transactions among different firms provide an important opportunity for inter-firm cooperation and collaboration. It gives rise to a network covering the entire industry, directly contributing to the formation of the local industry cluster. Moreover, from this network, local firms, both large and small, have enhanced their technology by receiving the competitive components from FIEs. Thus interaction between FDI and local firms has been a win-win partnership. FIEs have played a vital role in building supplier networks. They are not only a supplier to local large firms. They are a bridge between local large firms and SME firms, and a nexus for knowledge sharing and transfer of technology. Hence, the hub-and-spoke model is collaborated in the case of Qingdao, but with an unexpected twist: FIEs can play an important and positive role even if they are not the dominant hub firms.

CONCLUSIONS

The case of Qingdao is characterized by two outstanding features: first, in the web of local industrial cluster, local large firms have played a leading role, whereas FIEs have played a supporting role; second, the FIEs have nevertheless played a dynamic role by stimulating the integration of the otherwise fragmented local industry through their activities. Both features are significant, as they add to our understanding of the possible roles, both positive and negative, that may be played by FDI in LDCs.

The case study of Qingdao has highlighted the role of FIEs as supporting, yet dynamic forces. In existing models, positive perspectives on FIEs in local economy emphasize the role of FIEs as hub firms or leading firms in developing the local industry, whereas negative perspectives (e.g. dependency school) regard FIEs as exploiters of the local

economy. Even in the former, however, the ability for the local economy to retain the economic surplus is limited. In the Qingdao case, however, FIEs are found to be an inter-mediator between local large firms and local SMEs, precisely because their economic and technological supremacy. Moreover, by supplying core technology competitively to a collection of local large firms, the FIEs have ensured that the large Chinese firms, such as Haier, are able to deploy the most advanced technology in the world, but still manage to keep the prices down. This is indeed the secret of the success of Chinese electronic producers: Chinese firms like these in Qingdao are not only able to produce cost-efficiently, but also with decent technology, provided by some of the most established vendors in the field.

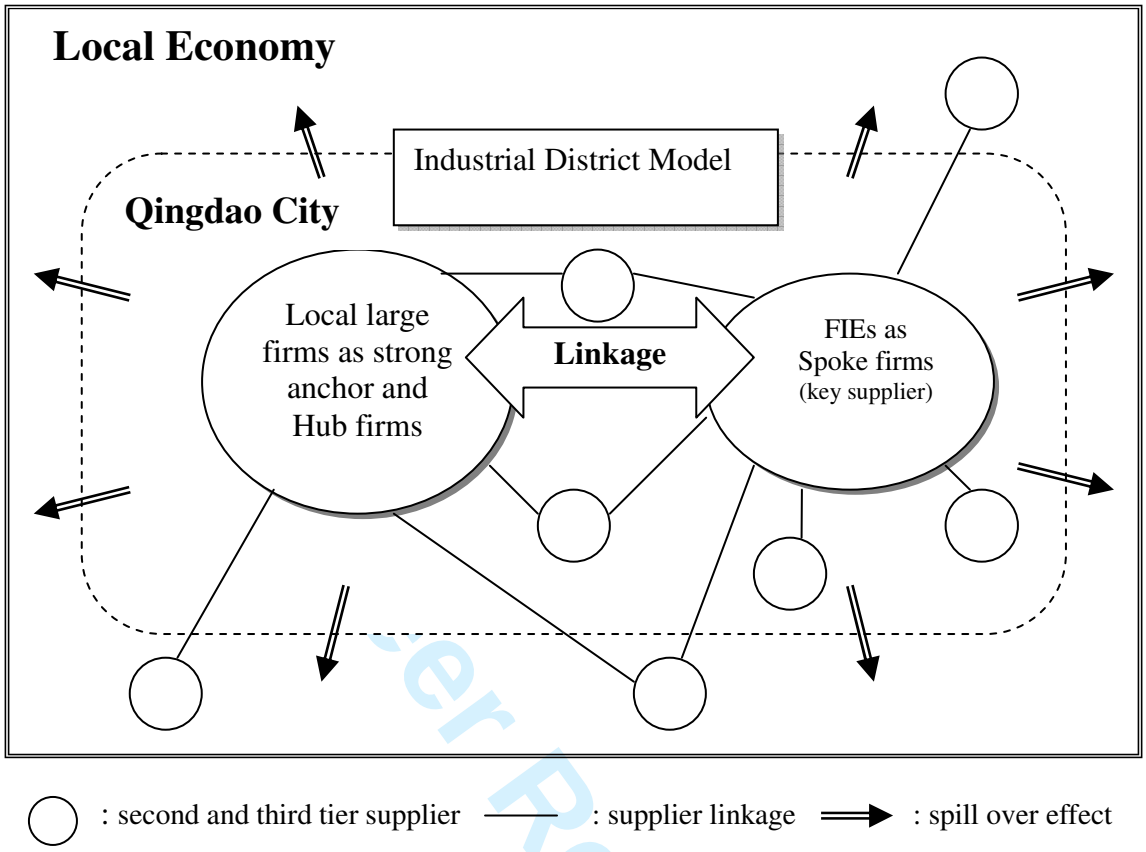
The bridging role of FIEs in local economy sheds new light on the dynamics of inter-firm linkages. Inter-firm linkages in the case of Qingdao are much more than a supplier-buyer relationship. They are also crucial channels where technological resources and managerial skills are shared among firms since R&D activities and technology transfer take place in the forms of inter-firm linkages. In addition, local firms are able to utilize the global network which is brought in by FIEs. Hence, by FIE's involvement as spoke firms in inter-firm linkages, relationships between hub firms and local SMEs become dynamically engaged.

So what makes this possible? This is obviously a question that needs to be explored further. Tentatively, though, we think that two factors are critical to this development: the considerable local industrial and institutional capacity; and the domestic firms' relative advantage in having access to a large domestic market. The former is manifested in the

ability of the local firms such as Haier to orchestrate its complex supplier-buyer and R&D networks and to implement best practices such as the just-in-time, zero distance policy. It is also evident in the local authority's success in establishing and expanding the development zones, around which much of the industrial cluster has developed. However, the role of the large Chinese domestic market can't be overestimated. It is this market that has lured the FDI in the first place, and it is here where the Chinese firms first perfected their manufacturing and organizational skills.

In concluding, it might be useful to consider the impact of this development on the local economy. Figure 5 depicts the key elements and linkages. FIEs are formally inter-linked with local large firms through joint ventures, strategic alliance, and subcontracting. Based upon the strong link between local large firms and FIEs, second and third tier suppliers are both directly and indirectly connected to local large firms which are the principal buyers and retainers of the economic profits, and the effects of such linkages are multiplied throughout the local economy.

Figure 5 Qingdao Model of Local Economic Development



Source: Final field research (2004)

The case of Qingdao carries implications for the practice of urban economic development, especially in view of the increasing popularity of industrial clustering as a strategy. The case shows that setting up specialized development zones can work, but only if there is sufficient extant industrial capacity and organizational skills in the area, and if FIEs and local suppliers can be induced to interact in a dynamic and mutually beneficial fashion.

Acknowledgements – The authors are grateful to two anonymous referees for insightful and constructive comments on improving an earlier version of the paper. All remaining errors remain the responsibility of the authors.

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Appendix 1 Final Sampled Firms

Key Firms	Location (Nationality of Firm))	Main Product	Components from local firms	Components from foreign firms (FDI)
1	ETDZ (China)	Commercial Air-conditioner	Tube, Valve, Package assembly, Install part assembly, Panel, Resin, Base, Fan, Steel	Compressor, IC, Control box assembly, Remote control, PWB assembly, Condenser, Switch, Motor
2	ETDZ (China)	Microwave	Resin, Motor, Plate, Panel, Out case, Oven, Box, Steel	Control, PWB, Cable, Transformer, Magnetron, IC
3	ETDZ (China)	Bottle cooler (refrigerator)	Resin, steel, Evaporate assembly	Compressor, Polyurethane assembly, Cover assembly Door foam assembly, motor
4	ETDZ (China)	Special Refrigerator	Cable, switch	Compressor, Control, Cover assembly, Plastic hardware, Thermostat, Four-way reserving valve, Programme timer, water valve, Motor
5	ETDZ (China)	Household refrigerator	Plastic, Electric cable	Compressor, Control, timer, Motor
6	ETDZ (Korea)	Electronic capacitors, condenser for PCB and PWB 1st tier supplier of no.1, 4, 5 firm	Rubber pad, Can, Aluminium foil and case, paper box	Chemical materials
7	ETDZ (HK)	Special silk screen, Plastic and steel hardware mould for	Steel (Shanghai Bao-steel)	Steel (Posco) Plastic (BASF)

		refrigerator and air-conditioner 1st tier supplier of no. 1, 4, 5		
8	ETDZ (Japan)	Compressor 1st tier supplier of no. 4, 5	Spray, punch	Steel (Posco, Nippon Steel), motor, micro fan, injection mould
9	ETDZ (Japan)	Tactile sheet, Safety unit for battery, Antenna, Encoder, Light touch switch, micro stick, remote control unit, transparent touch panel 1st tier supplier of no 1	Packing product, sub-raw materials (plastic)	Stein-less steel, Steel, PVD, micro chip
10	ETDZ (China)	Switch (1st tier of Hisense)	Plastic button, steel	N/A
11	ETDZ (Taiwan)	Electric wire, cable, connector, PCB components for household electronic goods 1st tier supplier of no.1, 4, 5	Tube, plastic, wire	N/A
12	ETDZ (Korea)	Electronic production Logo, Aluminium panel, TV components, Nickel coating 2nd tier supplier of no. 1, 2, 3, 4, 5	Switch, Bearing, paper packing box, rubber	Nickel, Aluminium, iron mould, Tape
13	ETDZ (UK)	PDP TV module components, PCB, IC, Flip circuit, SMT line, COB 1st tier supplier of Haier and Hisense	N/A	IC components, SMT procurement, LCD
14	ETDZ (HK)	Plastic frame 2nd tier supplier of Haier	N/A	Raw plastic material, core plant from BASF and DOWE
15	ETDZ (Japan)	Optical glass for camera phone, semiconductor, LCD photo-mask,	No local suppliers	All materials imported from Japan

		panel		
16	ETDZ (Japan)	Soft ware, REC, Coil AMM, Head, FDD	Spring,	Switch, micro injection moulding, precision dies
17	ETDZ (China)	Electromagnetism four-way reversing valve 2nd tier suppliers of no 1	Iron steel	N/A
18	ETDZ (Japan)	Electronic micro injection moulding, precision dies 2nd tier supplier of no. 8, 9, 16	N/A	Iron steel, Machinery plant from Japan's mother company
19	ETDZ (China)	Commercial Air conditioner, PC, TV mobile phone	Deflection Yoke, Fly back transformer (FBT), Cabinet assembly, Tube, Valve	Switch, IC, PCB, PDP module, LCD, Capacitor, Control box, Fan, Compressor, Panel assembly, micro speaker, dynamic receiver
20	ETDZ (Korea)	Mobile phone components such as super thin micro speaker, dynamic receiver 1st tier supplier of no. 19	Coil (wire), plastic frame	PCB, film, grill
21	ETDZ (Korea)	Silicon zener diode SMD zener & switching Silicon Rectifiers for TV, PC, monitor	Box	Raw materials for chip, glass (from Japan)
22	HTIP (America)	Motor for household electronic goods 1st tier supplier of no. 1, 3, 4, 5	Lamination, copper wire, end-shield, electronic goods	Core components of motor is from USA, Japan
23	HTIP (Australia)	Control unit with VFD for refrigerator, washing machine, air conditioner and dishwasher, remote control 1st tier supplier of	IC part, electric condenser, connector	Semi-conductor chip, PCB, Transformer

		no 1, 2, 4,5		
24	HTIP (China-Korea JV)	Wire, Plug, Power supply cord, SMD inductor and transformer, Sensor for air conditioner, line filter 1st tier supplier of no. 1, 2, 3, 4, 5	PVC, raw material for wire, cord	Hosing, Terminal plate
25	HTIP (Korea)	Micro-switch, transistor, Relay, thermostat, cordless motor for mobile phone, Desktop charger, Hand-free kit, Key pad assembly, headphone, DVD Rom, Dech Assembly, MP3 player 1st tier supplier of Haier and Hisense	Packing box	Integrated circuit, circuit controller, injection moulding, heat sink assembly
26	HTIP (Sweden)	EMIP (Ericsson M2M Intelligent Platform) IT networking for PDA mobile phone, ATM, POS, Logistic Haier group (27) is main customer	No local supplier	All systems from Sweden headquarter
27	HTIP (China)	Haier-PDM (Product digital management system)	Qingdao University Xin-sing, National Ocean University, Beijing University, Qinghua University Haier Central Research Institutes	N/A
28	HTIP (China)	Control unit, PCB, remote control, PDM Haier's branch firm	LED, Plastic	Semiconductor chip, condenser, switch
*29	HTIP (China)	Soft-ware, IT networking 'Haier' – headquarter firm's	Qinghua University IT networking system	Cisco system, Intel

		networking*		
30	HTIP (China)	Washing machine	Housing, Shaft, Tube, Bearing, Pump	Motor assembly, PWB assembly, IC, Panel assembly, Cover assembly, Valve, Steel
31	HTIP (America)	Connector 2nd tier supplier of Haier	N/A	Plastic, Metal
32	HTIP (America)	PCB, IC, Control parts for all household electronic goods 2nd tier supplier of Haier, Hisense, Aucma	N/A	Integrated circuit chip
*33	HTIP (China)	Electronic Cash register *Spin-off from Hisense computer co. Ltd	Power supply, Capacitor, adaptor, monitor, Cable	IC, LCD, PCB, DVD Rom, FDD, Connector, PWB assembly, inductor, Diode, Heat sink assembly, transistor Hardware, CPU
34	HTIP (UK)	Control, Thermostats, Timer, Valve for washing machines, air conditioner, dishwasher, refrigerators 1st tier supplier of Haier, Hisense, Aucma	Spring, Metal, Packing box, plastic	Capillary tube, special metal parts from Italy

Source: Field work (2004)

Table 1 Distribution of gross industrial output value (GIOV), value added (VA) and employment in Qingdao, 2002

	GIOV Share of City total	VA Share of City total	Employment Share
Food and beverage product	5.5%	13.4%	12.0%
Tobacco products	1.9%	4.0%	0.5%
Textiles	3.7%	6.6%	10.2%
Apparel; dressing and dying of fur	1.7%	2.9%	8.3%
Tanning and dressing of leather	1.2%	4.8%	11.7%
Wood product	0.1%	0.3%	0.6%
Paper and Allied product	0.9%	1.9%	2.2%
Printing and publishing	0.6%	0.7%	1.0%
Coke and refined petroleum	1.4%	3.5%	0.8%
Chemicals	2.4%	4.3%	6.2%
Rubber and Plastics	4.7%	8.2%	11.2%
Other non-metallic products	0.9%	2.6%	3.5%
Primary metal industry	2.1%	2.4%	2.4%
Fabricated metal product	1.6%	3.9%	4.6%
Machinery and equipment	2.6%	4.9%	5.8%
Medical products	0.5%	1.0%	0.9%
Electrical machinery	**36.7%**	**19.2%**	**7.1%**
Radio, TV and communication	**24.8%**	**8.1%**	**5.6%**
Motor vehicles	6.6%	7.2%	5.7%
Total	100.0%	100.0%	100.0%

Source: Qingdao Statistical Yearbook 2003.

Table 2 Ratio of FDI in GDP in ETDZ and HTIP in Qingdao

Year	Amount of FDI in ETDZ Unit: 100 million UDS	Share of FDI in GDP (%) FDI/GDP in ETDZ	Amount of FDI in HTIP Unit: 100 million USD	Share of FDI in GDP (%) FDI/GDP in HTIP
1994	1.0	54.2%	0.97	41.1%
1995	1.5	54.9%	1.14	33.2%
1996	1.7	46.6%	0.91	20.0%
1997	2.0	41.2%	1.4	23.6%
1998	2.10	34.7%	1.45	20.3%
1999	2.20	28.0%	1.7	20.4%
2000	2.89	27.9%	2.5	24.9%
2001	4.64	29.6%	2.61	20.9%
2002	4.73	23.1%	3.05	20.0%

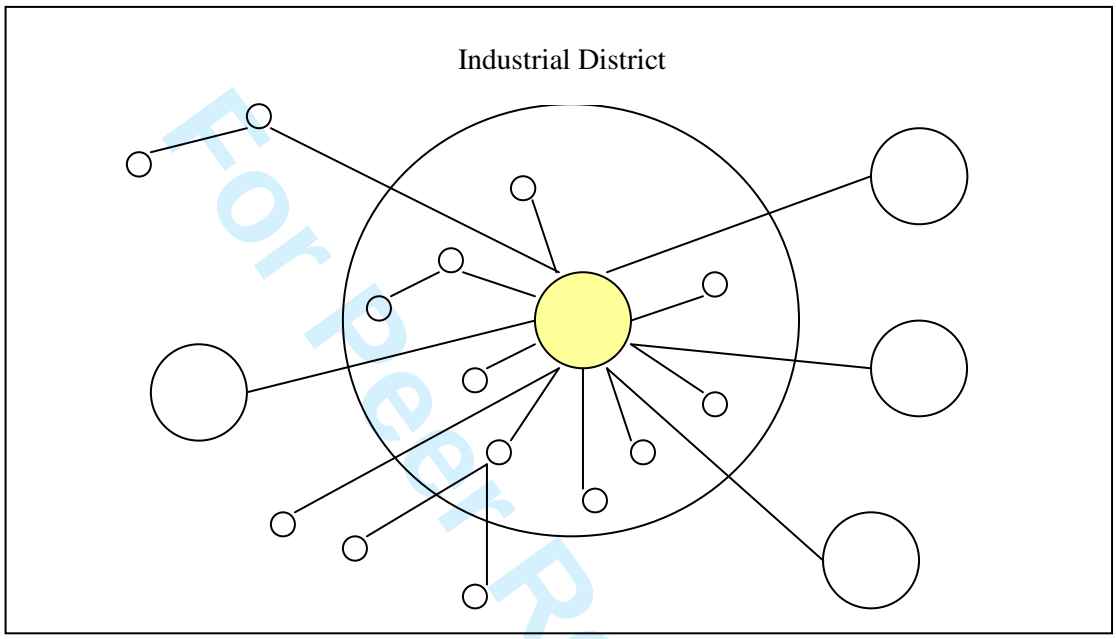
Source: Huangdao ETDZ Statistical Yearbook (2003); Qingdao Laoshanqu Commerce Investment Guidebook by HTIP Officials (2001, 2003)

Table 3 Foreign invested enterprises in Haier Group's Industrial Park (ETDZ, HTIP)

Haier Melloni Washing machine	Haier-Baihui Plastics
Mitsubishi Heavy Industry Haier (Commercial Air-conditioner	Haishimao Electronic plastics
Haier-Happyline Kimchi Refrigerator	Haier-Weicheng Electronic Plastics
Haier-Carrier Commercial Refrigerator	Qingdao Meier Plastic
Haire CCT (Telecommunicatuin)	Haier Special Steel (Posco)
Sanyo Electronic Components (Compressor)	Haier-Haiyongli Digital Net
Sanyo Electronic Machinery (household electronic)	Haier special refrigerator
Haier Hong-ji Electrical Appliance	TDK
Haier-SKD Electronic Component	Haier-Ericsson
Haier Dish washer	Haier home electronic appliance
	Haier commercial air conditioner
	Haier C-MRV

Source: Final field work (2004)

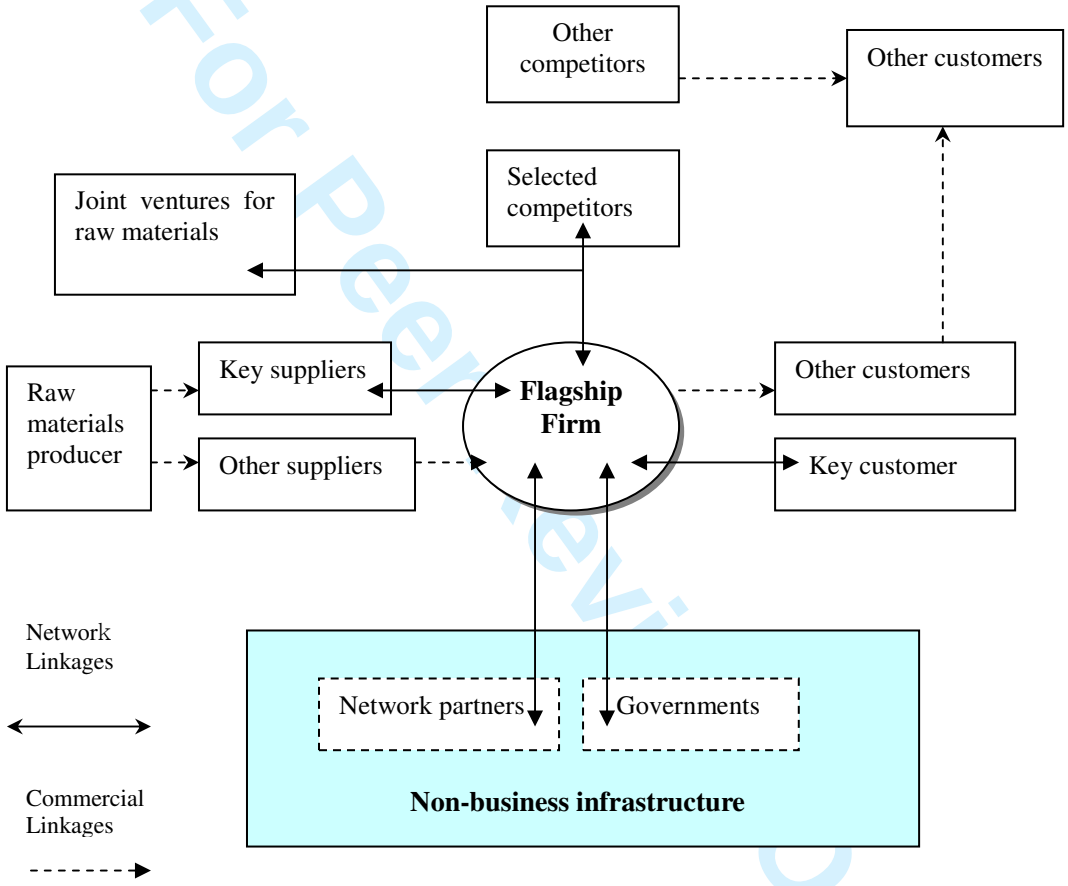
Figure 1 Hub and Spoke model



Hub firms Large locally headquartered firms Small local firms Inter-firm linkage

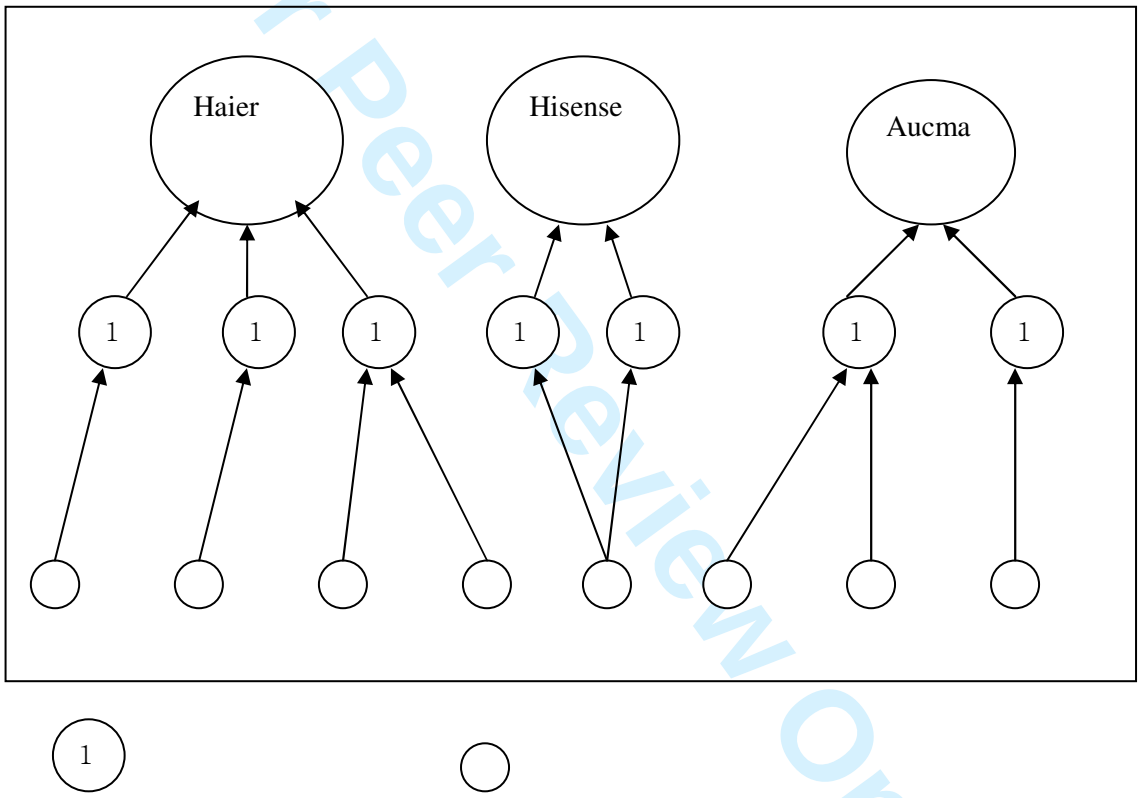
Source: Markusen (1996, p. 297)

Figure 2 The flagship firm and the five partners business system



Source: Rugman and D'Cruz (2000), p. 31

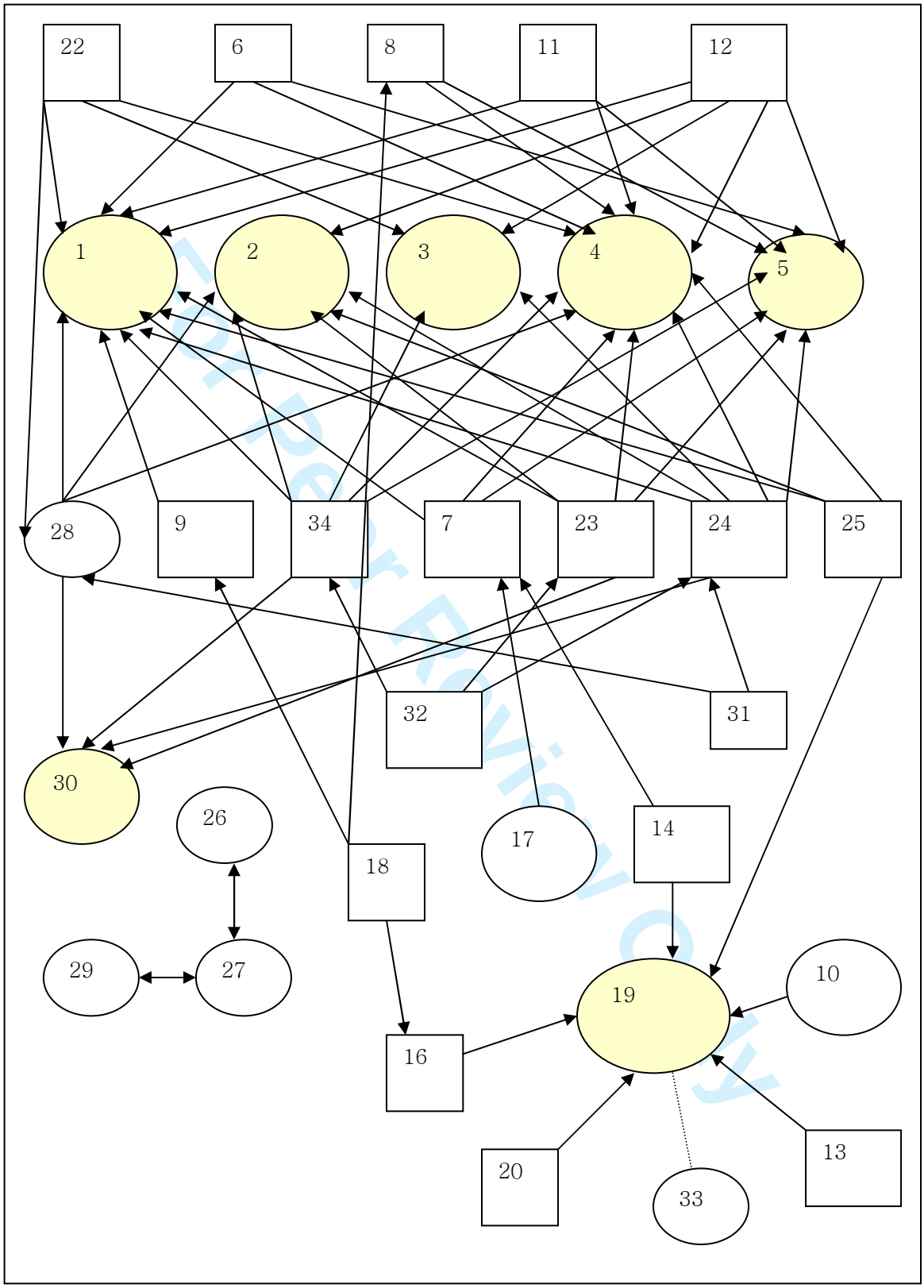
Figure 3 The structure of supply network in Qingdao during 1990s



First-tier Supplier Second-tier and third-tier suppliers

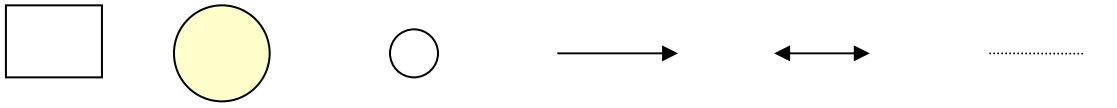
Source: Interview results from final field work (2004)

Figure 4 Inter-firm linkages in Qingdao HTIP and Huangdao ETDZ (Interview results)



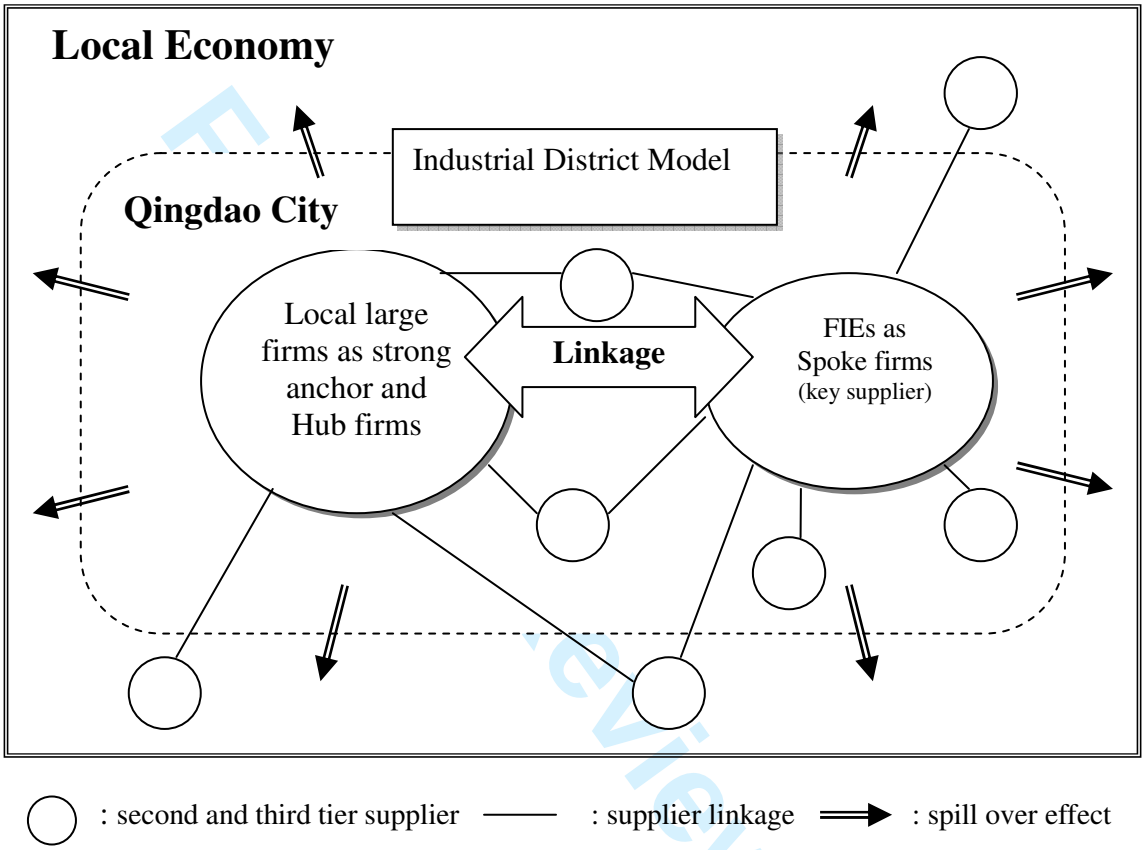
Source: Final field work (2004)

Firm number 1-21 (located in ETDZ) 22-34 (located in HTIP)



FIE Large Firm Local supplier supply linkage research co-operation Spin-off

Figure 5 Qingdao Model of Local Economic Development



Source: Final field research (2004)